

Elaboration of Ecological Quality Objectives as a step forward in cooperation to protect the marine environment in the Northwest Pacific

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Background

- Good environmental quality is necessary for the national economies and the wellbeing of the populations. The ecosystem based management with proper marine spatial planning seems to be the only approach ensuring sustainable use of the natural resources and services.
- Achievement of Good Environmental Status (GEnS) in marine areas through the development and implementation of the general **Ecological Quality Objectives (EcoQOs)** is one of the major directions in the goal-setting of modern society.
- EU is a most advanced region of **EcoQOs** implementation but the assessment of suitability of this concept to other regions with quite different conditions is needed

Aims of presentation:

- **To discuss the relevance of EcoQOs approach to the environmental problems and their monitoring in the northwestern Pacific (NOWPAP region);**
- **To outline major ecological issues in the northwestern Pacific region**
- **To present set of possible targets and indicators which could be used to monitor the EcoQOS in the northwestern Pacific region;**
- **To highlight the features and difficulties of the EcoQOs implementation in the northwestern Pacific region.**

Study area

Northwest Pacific (NOWPAP) is a transboundary region with very different socio-economical situations;

The natural conditions are also quite diverse;

There are a lot of environmental problems in this region those could be resolved by the joint efforts of all countries only;



Features of NOWPAP region relevant to ecosystems based approach:

- High unevenness of natural and socio-economic conditions
- No reliable legislative framework for the resolving of environmental issues on the regional level.
- The importance of international collaboration is enhanced
- **UNEP NOWPAP** as one of the **UNEP Regional Seas** programs provides such collaboration between China, Japan, Republic of Korea, and Russia on the broad range of environmental issues.

Major ecological issues in the NOWPAP region based on overviews of NOWPAP experts (SOMER, SOMER-2 etc.)



List of **Ecological Quality Objectives** is based on the assessment of environmental problems in the NOWPAP region

- **Biological and habitat diversity are not changed significantly due to anthropogenic pressure;**
- **Alien species are at levels that do not adversely alter the ecosystems;**
- **Eutrophication adverse effects (such as loss of biodiversity, ecosystem degradation, harmful algal blooms, and oxygen deficiency in bottom waters) are absent;**
- **Contaminants cause no significant impact on coastal and marine ecosystems and human health;**
- **Marine litter does not adversely affect coastal and marine environments .**

Ecological Quality Objectives are **very general** and set of **targets and indicators** are necessary for the assessment of progress in the implementation of EcoQOs

- **List of 12 targets and 24 indicators has been formulated and suggested according to the EcoQOs nature and ecological issues in our region;**

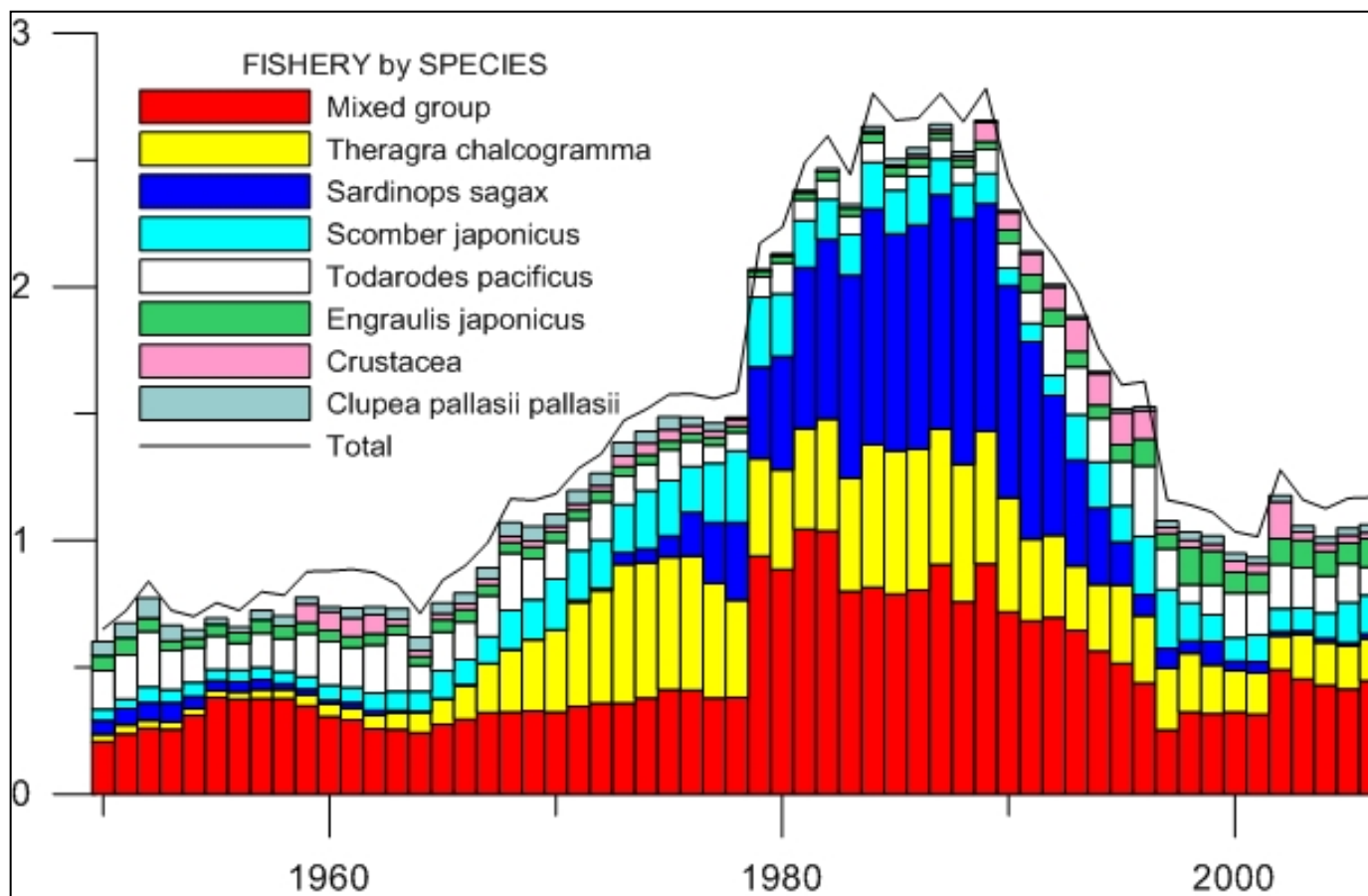
Ecological Quality Objectives	Operational Criteria (Targets)	Indicators
1. Biological and habitat diversity are not changed significantly due to anthropogenic pressure	1.1. Species diversity of marine mammals and waterbirds	1.1.1. Abundance, distribution and population growth rates of marine mammals 1.1.2. Abundance and productivity of key waterbird species
	1.2. Species, age and size structure of fish stocks	1.2.1. Catch/biomass ratio 1.2.2. Spawning Stock Biomass (SSB) 1.2.3. Proportion of large fish (for selected species at the top of food webs)
	1.3. Distribution of benthic and pelagic communities and their status	1.3.1. Distribution 1.3.2. Condition of the typical species and communities 1.3.3. Hydrological and chemical conditions
2. Alien species are at levels that do not adversely alter the ecosystems	2.1. Abundance and state characterization of alien species	2.1.1. Trends in spatial distribution and biomass of alien species
	2.2. Environmental impact of alien species	2.2.1. Ratio between alien species and native species and their interaction at the level of ecosystem, habitats and species
3. Eutrophication adverse effects (such as loss of biodiversity, ecosystem degradation, harmful algal blooms, and oxygen deficiency in bottom waters) are absent	3.1. Nutrients concentration	3.1.1. Nutrients concentration in the water column 3.1.2. Nutrient ratios (silica, nitrogen and phosphorus)
	3.2. Direct effects of nutrient enrichment	3.2.1. Chlorophyll concentration in the water column 3.2.2. Species composition and abundance of toxic microalgae 3.2.3. Harmful algal blooms (HABs) 3.2.4. Abundance of opportunistic macroalgae
	3.3. Indirect effects of nutrient enrichment	3.3.1. Seasonal hypoxia, dissolved oxygen changes and size of the area concerned
4. Contaminants cause no significant impact on coastal and marine ecosystems and human health	4.1. Concentration of contaminants	4.1.1. Concentration of the contaminants in sediments, water and hydrobionts 4.1.2. Exceeding of MPC in aquatic organisms and frequency of such cases
	4.2. Effects of contaminants	4.2.1. Levels of pollution effects on the ecosystem components concerned, where a cause/effect relationship has been established
5. Marine litter does not adversely affect coastal and marine environments	5.1. Characteristics of litter in the marine and coastal environment	5.1.1. Trends in the amount and composition of litter washed ashore 5.1.2. Trends in the amount of litter in the water column and deposited on the seafloor 5.1.3. Trends in the amount, distribution and composition of micro-particles
	5.2. Impacts of litter on marine life	5.2.1. Trends in the amount and composition of litter ingested by marine animals

Possibility of using suggested EcoQOs indicators in NOWPAP region

- **These targets and indicators were analyzed from the point of view their suitability to the NOWPAP region by efforts of experts from China, Japan, Korea and Russia as NOWPAP POMRAC activity in close collaboration with other NOWPAP RACs**
- **List of experts provided input to the analysis of indicators:**
Dr. Eugeny BORISOVETS (Russia), Dr. Jongseong KHIM (Republic of Korea), Mr. Nikolay KOZLOVSKY (Russia), Dr. Wenlu LAN (China), Dr. Olga LUKYANOVA (Russia), Prof. Osamu MATSUDA (Japan), Dr. Jongseong RYU (Republic of Korea), Dr. Vladimir SHULKIN (Russia), Prof. Vyacheslav SHUNTOV (Russia), Dr. Alexander VDOVIN (Russia).
- **“Regional overview of possible Ecological Quality Objective indicators for the NOWPAP region” prepared by NOWPAP POMRAC will be the result of this analysis**

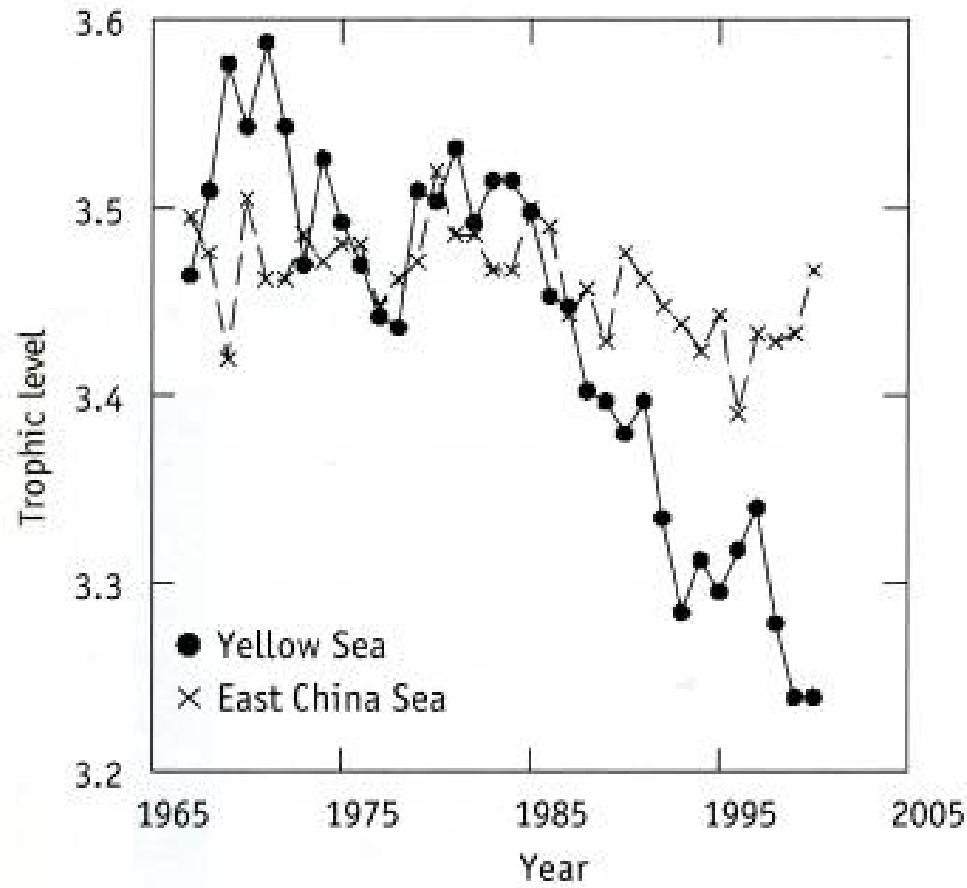
EcoQO 1: Biological and habitat diversity are not changed significantly due to anthropogenic pressure

Operational criteria	Suggested indicators	China	Japan	Korea	Russia
1.1. Species diversity of marine mammals and waterbirds	1.1.1. Abundance, distribution and population growth rates of <u>marine mammals</u>	1.1.1. No available data	1.1.1. Not enough data (mostly scientific research)	1.1.1. Possible (protected species only)	1.1.1. No reliable data
	1.1.2. Abundance and productivity of <u>key waterbird species</u>	1.1.2. Possible (abundance only)	1.1.2. Not enough data (mostly scientific research)	1.1.2. Possible (endangered species only)	1.1.2. Possible
1.2. Species, age and size structure of fish stocks	1.2.1. Catch/biomass	1.2.1. Not enough data	1.2.1. Possible	1.2.1. Possible	1.2.1. Possible
	1.2.2. Spawning Stock Biomass	1.2.2. Not enough data	1.2.2. Not enough data	1.2.2. Possible	1.2.2. Possible
	1.2.3. Proportion of large fish	1.2.3. Not enough data	1.2.3. Not enough data	1.2.3. Possible	1.2.3. Possible (for sturgeon)
1.3. Distribution of benthic and pelagic communities and their status	1.3.1. Distribution	1.3.1. Possible	Not at this moment (scientific data available)	1.3.1. Possible	1.3.1. Possible
	1.3.2. Condition of the typical species and communities	1.3.2. Possible		1.3.2. Possible	1.3.2. Possible
	1.3.3. Hydrological/chemical conditions	1.3.3. Not enough data		1.3.3. Possible	1.3.3. Possible



Landing of main fish resources in the northeast NOWPAP sea area during last 60 years (<http://www.fao.org/fishery/statistics>)

Trophic level of resource organisms in the catches of the Yellow Sea and East China Sea. (Source: Marine Ecosystems of the North Pacific, 2004)

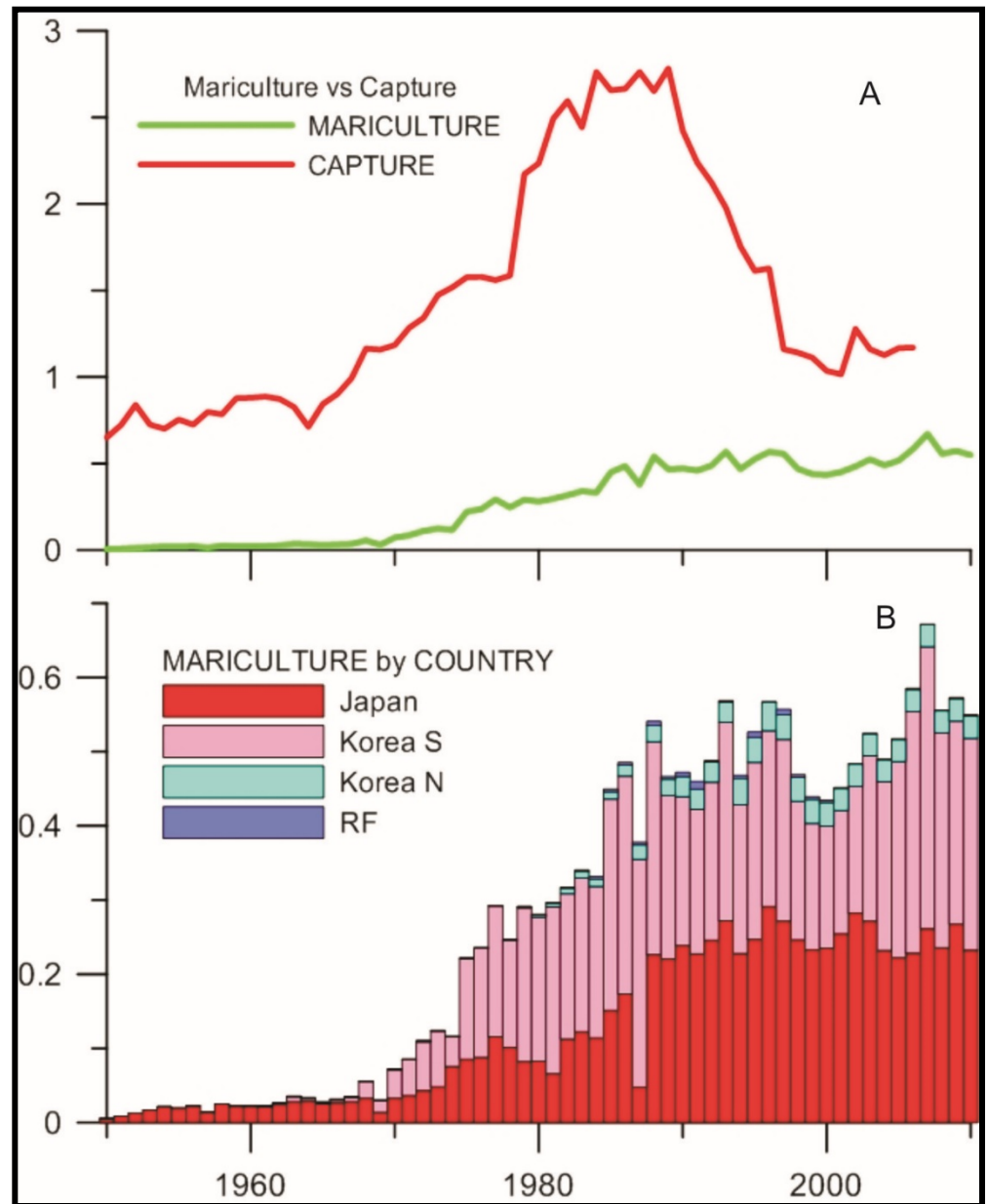


EcoQO 2: Alien species are at levels that do not adversely alter the ecosystems

Operational criteria	Suggested indicators	China	Japan	Korea	Russia
2.1. Abundance and state characterization of alien species	Trends in spatial distribution and biomass of alien species	Data are limited	Not at this moment (some scientific data might be available)	Under development	Data are limited
2.2. Environmental impact of alien species	Ratio between alien species and native species and their interaction	Data are limited	Not at this moment (some scientific data might be available)	Under development	Data are limited

The quota of mariculture and capture of fish resources in the northeast NOWPAP sea area during last 60 years

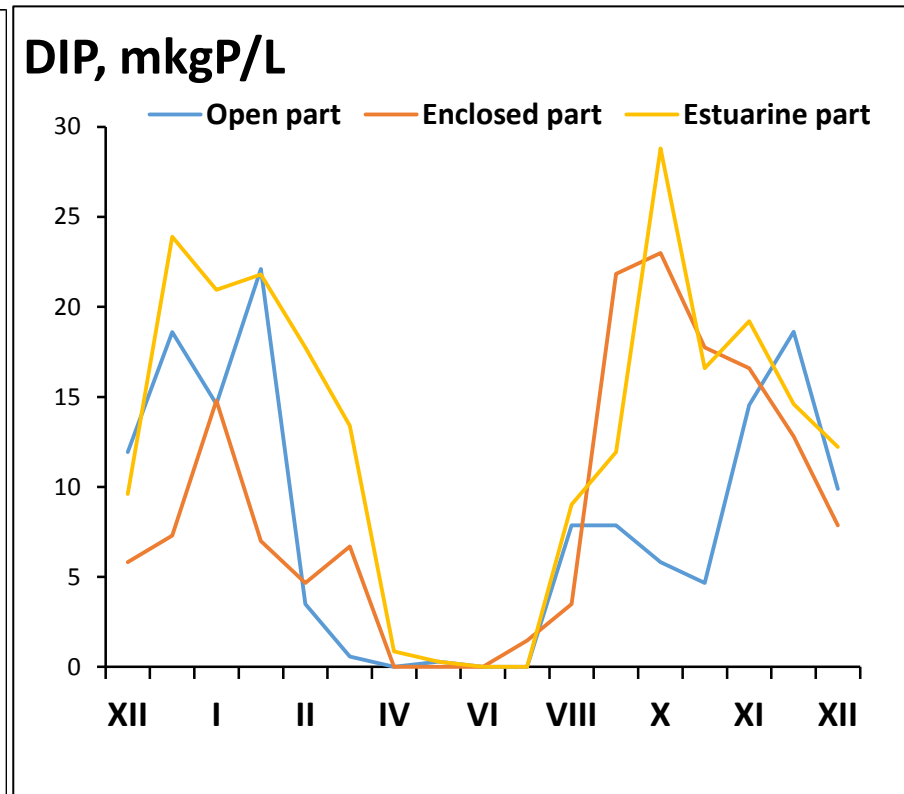
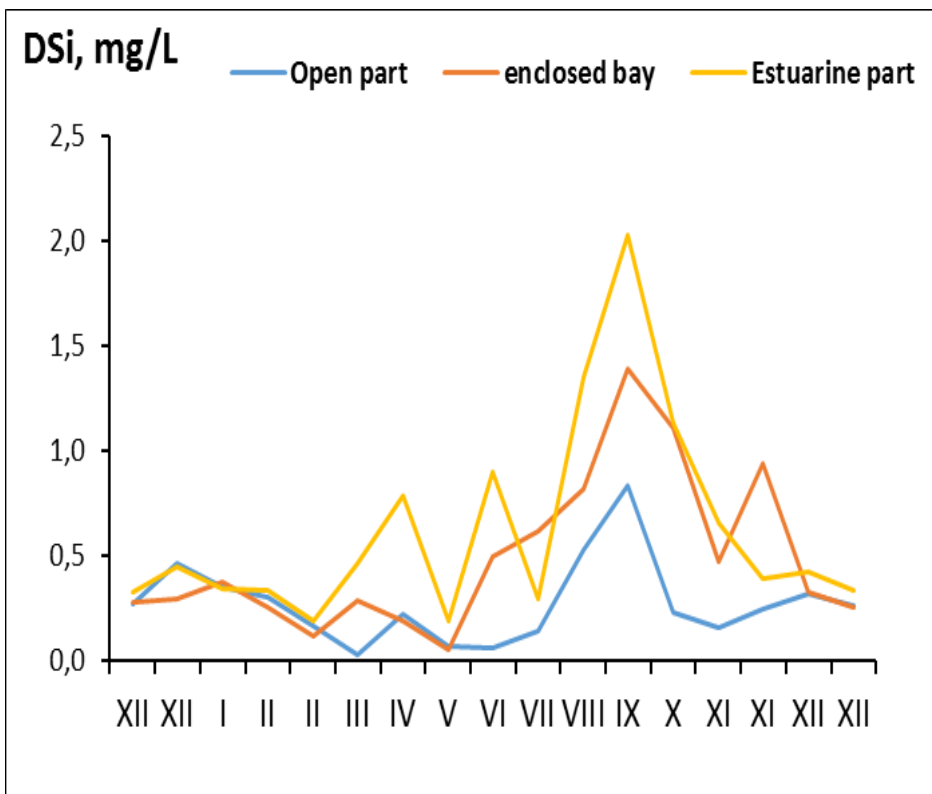
<http://www.fao.org/fishery/statistics>



EcoQO 3: Eutrophication adverse effects are absent

Operational criteria	Suggested indicators	China	Japan	Korea	Russia
3.1. Nutrients concentration	3.1.1. Nutrients concentration in the water column	3.1.1. Possible	3.1.1. Possible	3.1.1. Possible	3.1.1. Possible
	3.1.2. Nutrient ratios (N:P:Si)	3.1.2. Possible (from scientific studies)	3.1.2. Possible (mostly from scientific studies)	3.1.2. Possible	3.1.2. Possible (though data are limited)
3.2. Direct effects of nutrient enrichment	3.2.1. <i>Chlorophyll a</i> concentration in the water column	3.2.1. Possible	3.2.1. Possible	3.2.1. Possible (though data are limited)	3.2.1. Possible (though data are limited)
	3.2.2. Species composition and abundance of toxic microalgae	3.2.2. Data are limited	3.2.2. Possible	3.2.2. Possible (though data are limited)	3.2.2. Possible (though data are limited)
	3.2.3. Harmful algal blooms (HABs)	3.2.3. Possible	3.2.3. Possible	3.2.3. Possible (data are limited)	3.2.3. Possible (data are limited)
	3.2.4. Abundance of opportunistic macroalgae	3.2.4. Possible (data are limited)	3.2.4. Data not available	3.2.4. Data not available	3.2.4. Possible (data are limited)
3.3. Indirect effects of nutrient enrichment	Seasonal hypoxia, dissolved oxygen changes and size of the area concerned	Data are limited	Possible	Possible (though data are limited)	Possible (though data are limited)

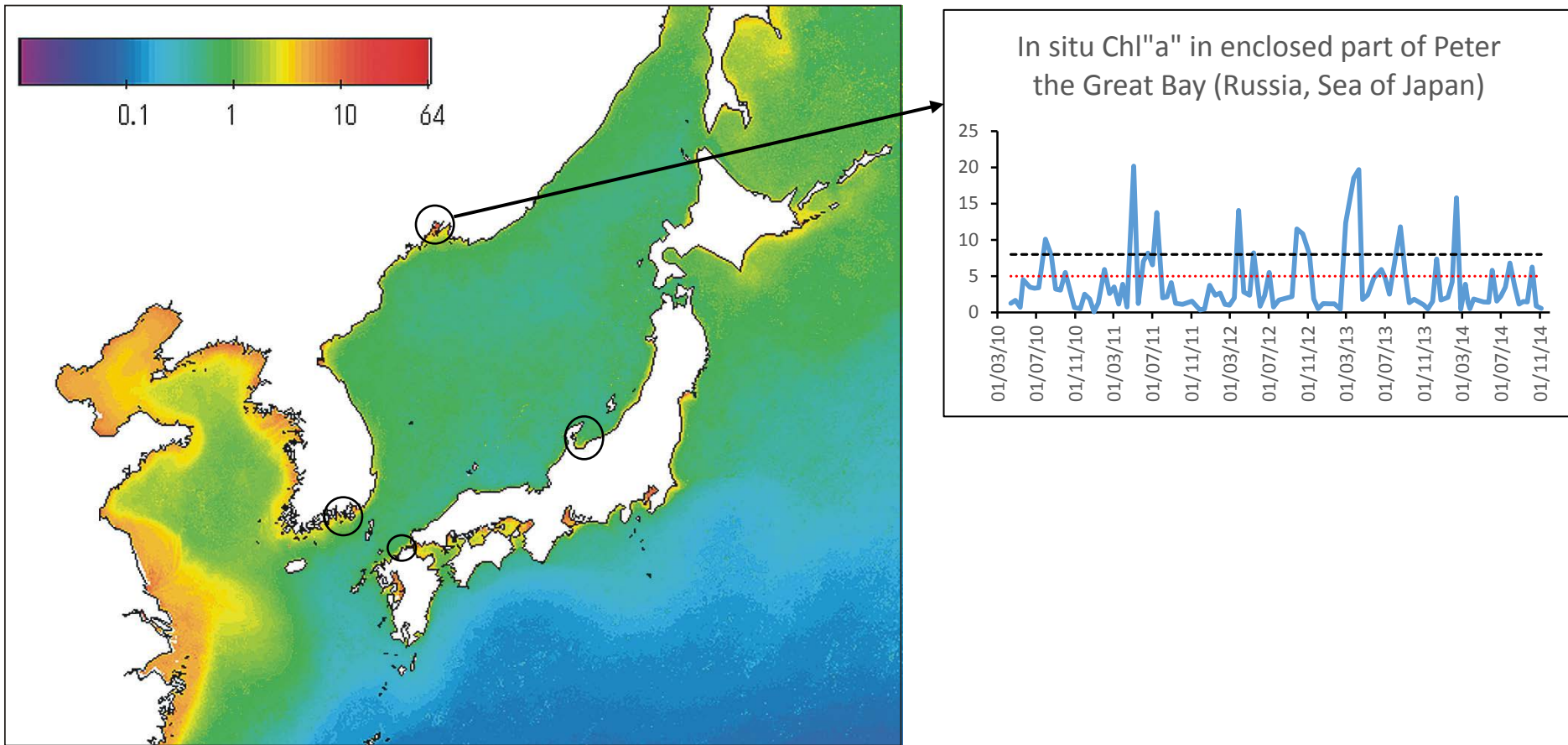
Nutrients concentration in the water column – necessity to take into account temporal variability with different time scales



Seasonal changes of DSi and DIP in the different parts of Amursky Bay

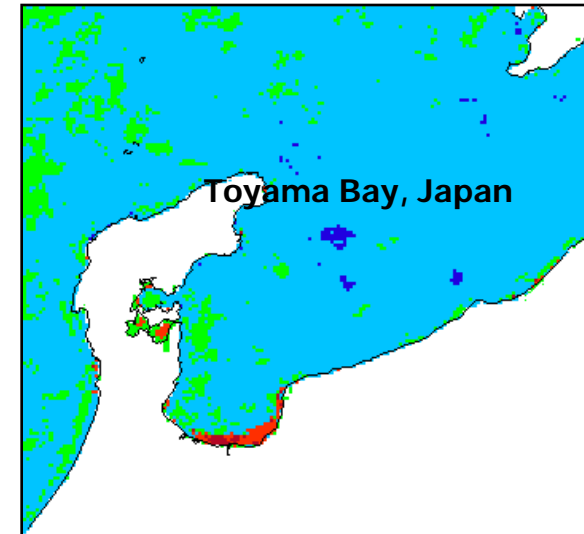
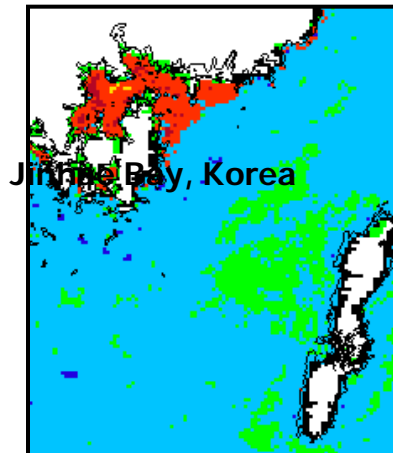
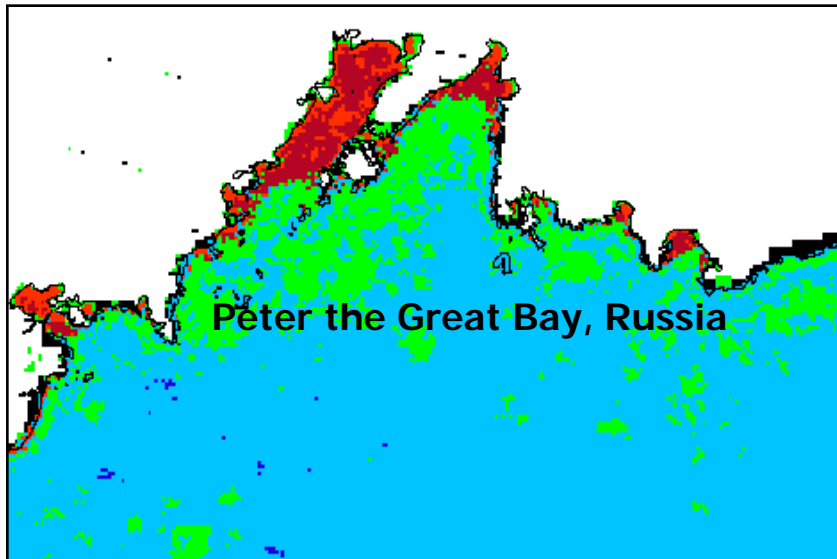
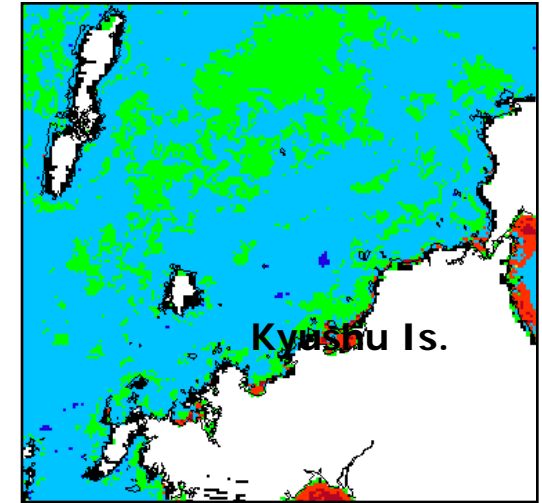
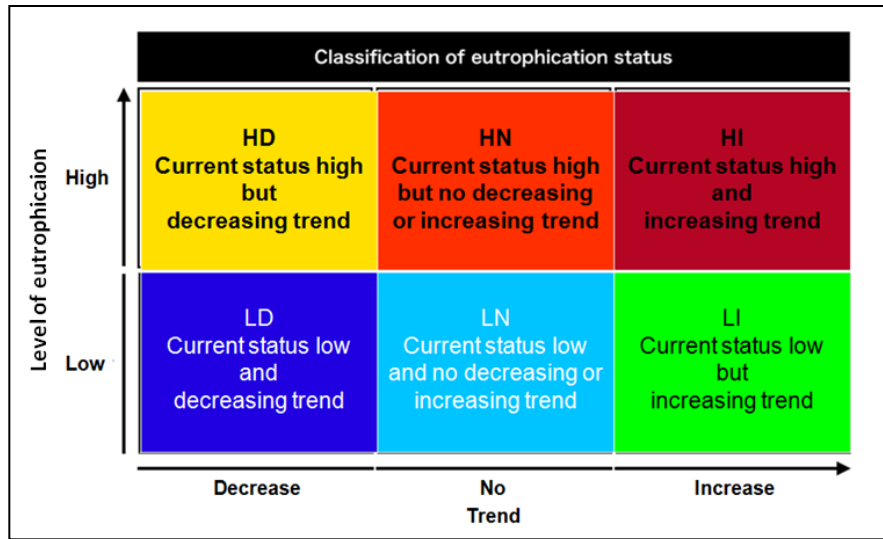
Direct effects of nutrient enrichment:

- Chlorophyll "a" concentration as proxy of phytoplankton biomass



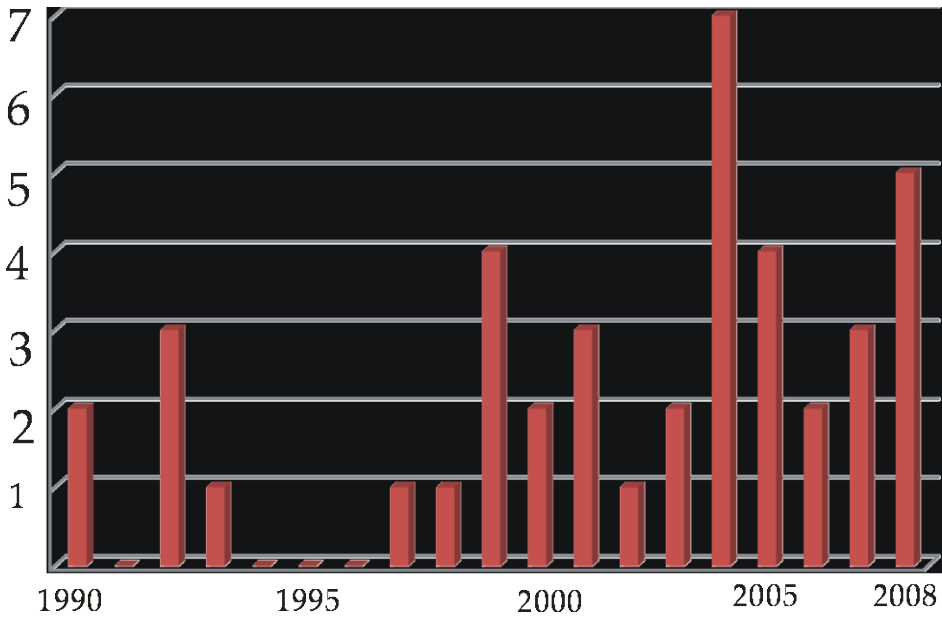
13-year (1997-2009) averaged satellite derived chlorophyll-a concentration in the NOWPAP region (Source: Integrated Report on Eutrophication Assessment in Selected Sea Areas in the NOWPAP Region. NOWPAP CEARAC 2011)

Classification of eutrophication status of selected NOWPAP areas by satellite derived Chl"a" (Source: Integrated Report on Eutrophication Assessment in Selected Sea Areas in the NOWPAP Region. NOWPAP CEARAC 2011)



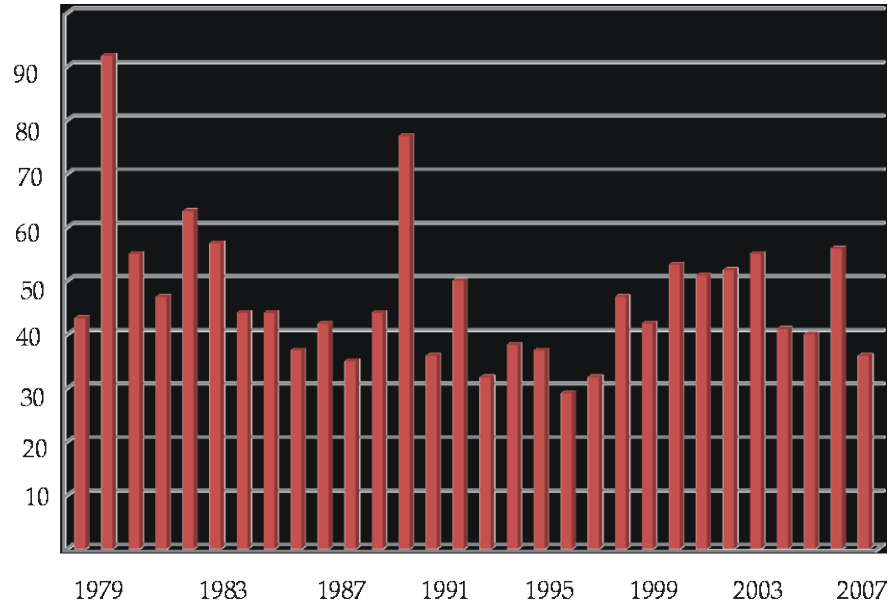
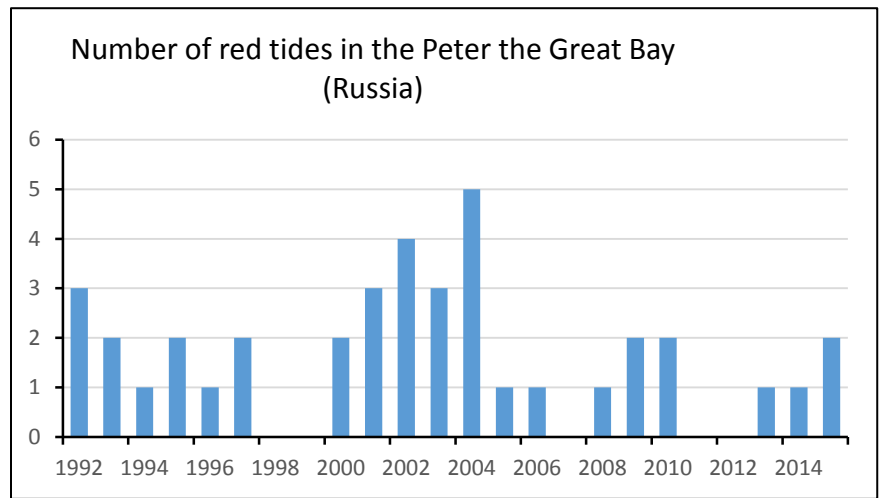
Direct effects of nutrient enrichment:

- Harmful algae blooms (HABs)



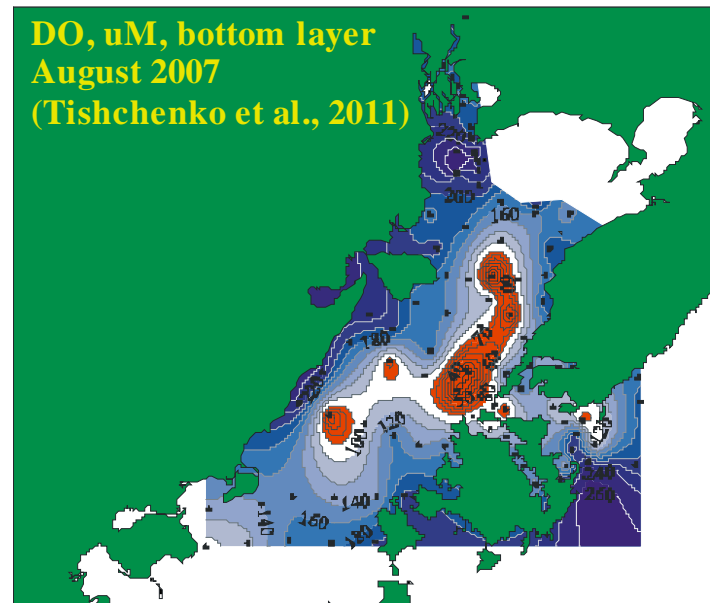
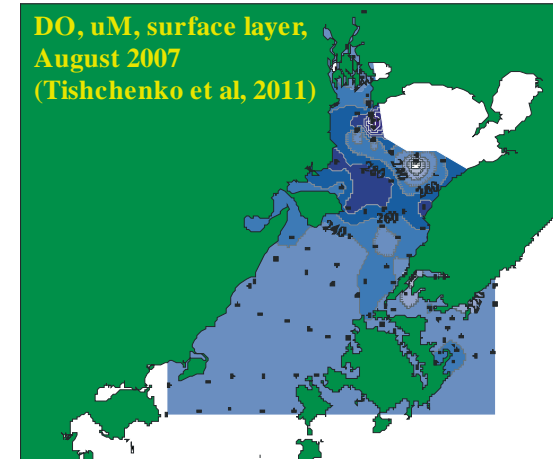
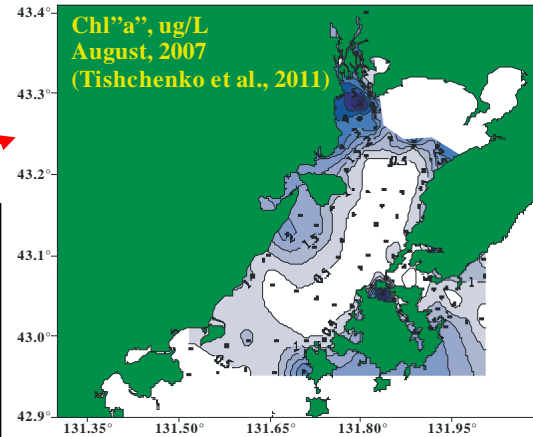
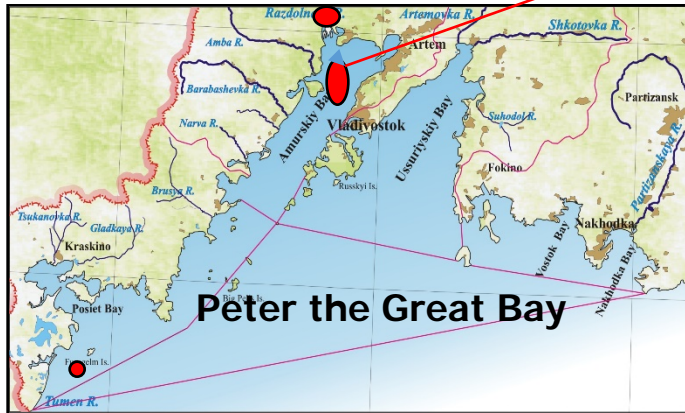
Number of red tides events at the Dalian area (northeast China)

Source: Integrated Report on Harmful Algal Blooms for the NOWPAP Region. NOWPAP CEARAC 2011



Number of red tide events at the northwestern Kyushu (Japan)

Hypoxia in bottom waters of Peter the Great Bay, Russia (by Tishchenko et al., 2011, 2013, POI FEBRAS):

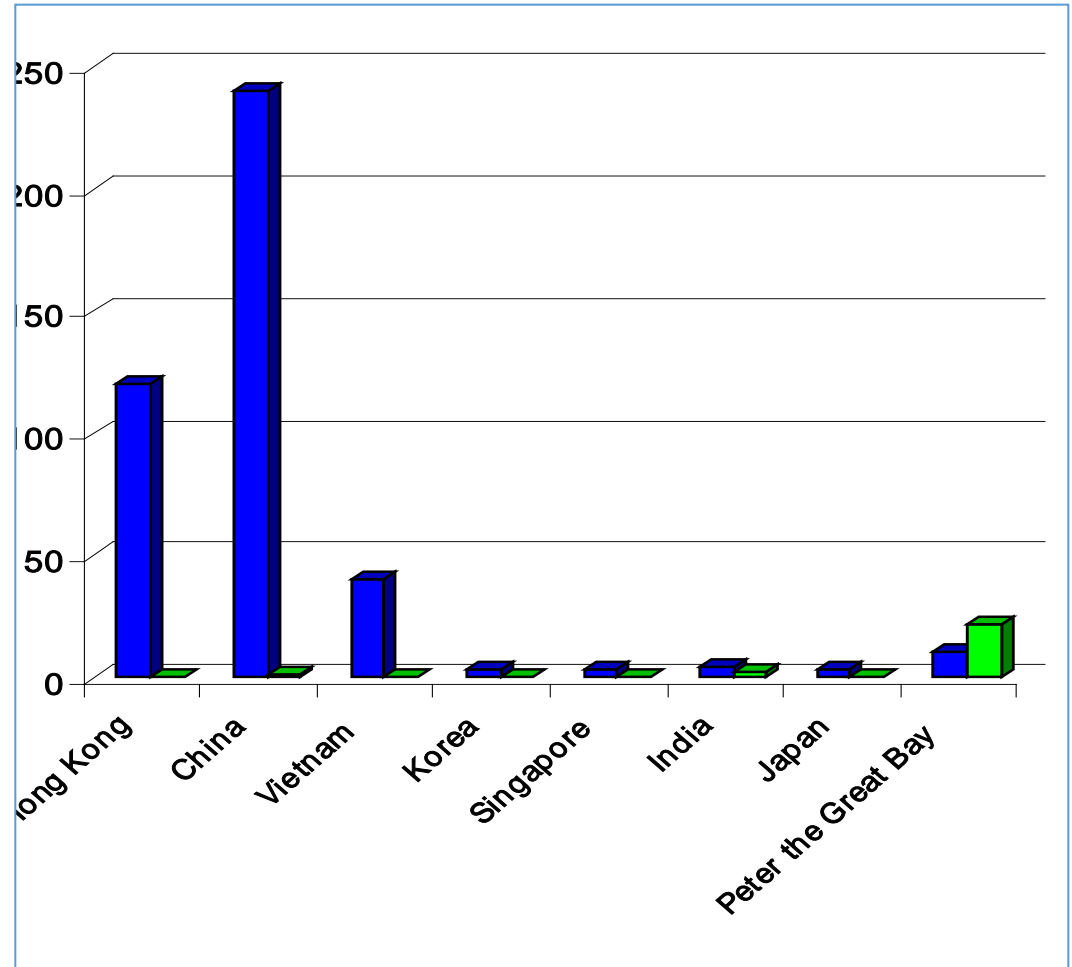


EcoQO 4: Contaminants cause no significant impact on coastal and marine ecosystems and human health

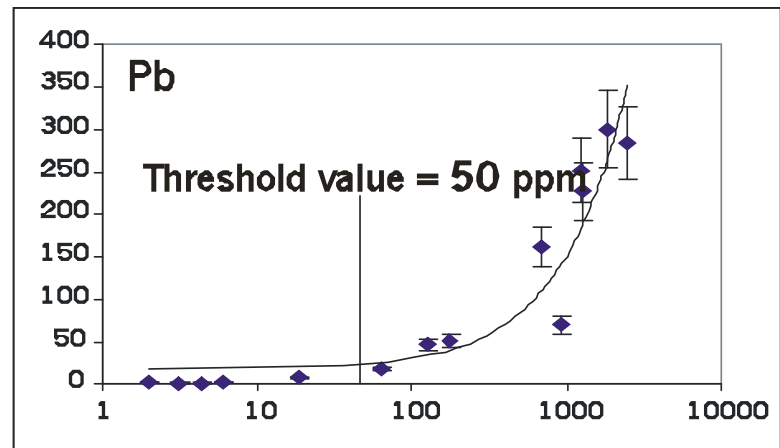
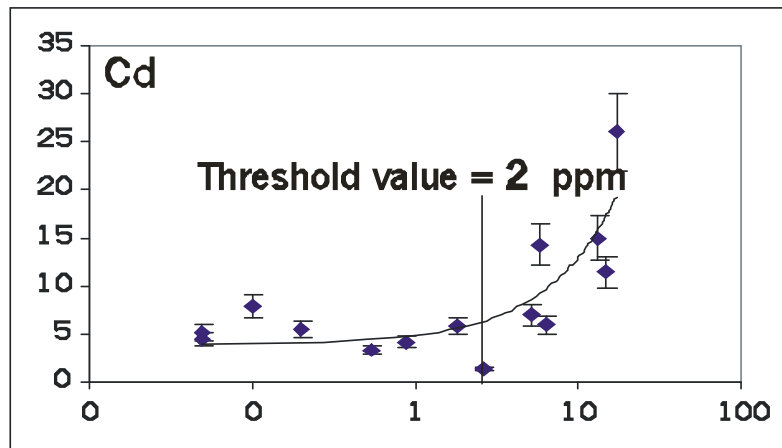
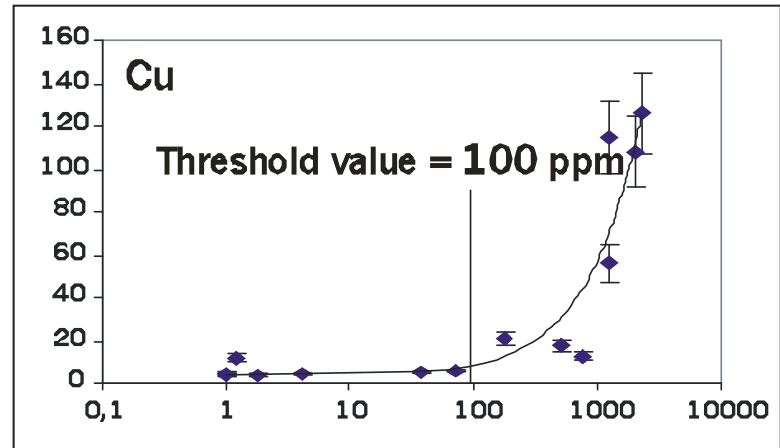
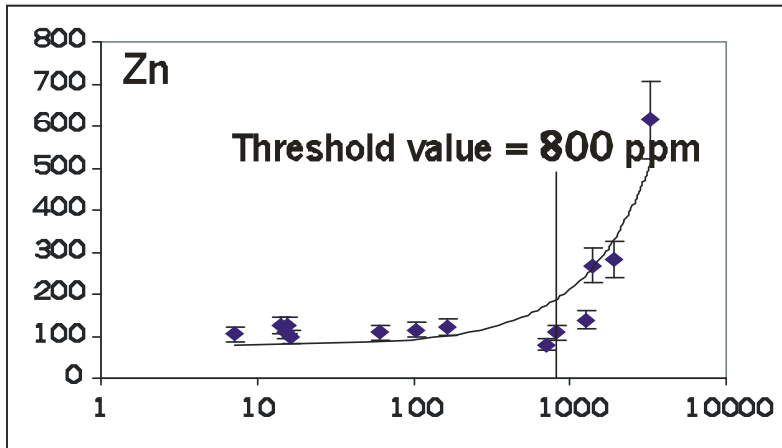
Operational criteria	Suggested indicators	China	Japan	Korea	Russia
4.1. Concentration of contaminants	4.1.1. Concentration of the contaminants in sediments, water and organisms	4.1.1. Possible (in sediments and water)	4.1.1. Possible	4.1.1. Possible (in sediments and organisms)	4.1.1. Possible (in sediments and organisms)
	4.1.2. Exceeding of MPC in aquatic organisms and frequency of such cases	4.1.2. Not at this moment (some scientific data might be available)	4.1.2. Not at this moment (some scientific data might be available)	4.1.2. Possible	4.1.2. Possible
4.2. Effects of contaminants	Levels of pollution effects on the ecosystem components concerned, where a cause/effect relationship has been established	Not at this moment	Not at this moment (some scientific data might be available)	Possible	Not at this moment

Data of Mussel Watch program on OCP content (ng/g) in mussels from the Asia-Pacific region and from the Peter the Great Bay (Monirith et al., 2003; Lukyanova 2013):

There is notable difference in POPs concentration in mussels from the different NOWPAP countries



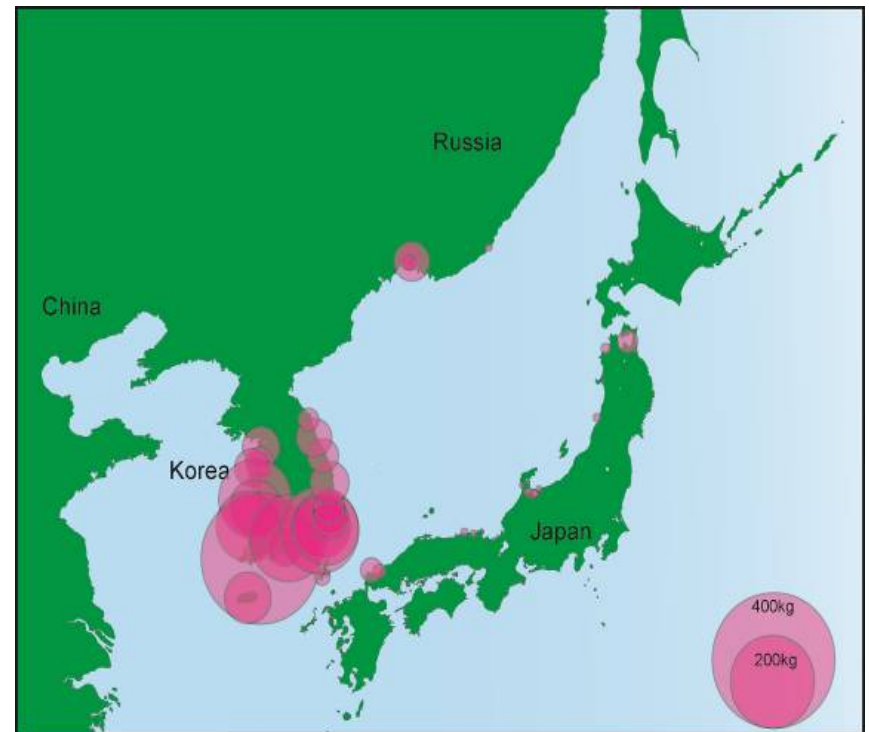
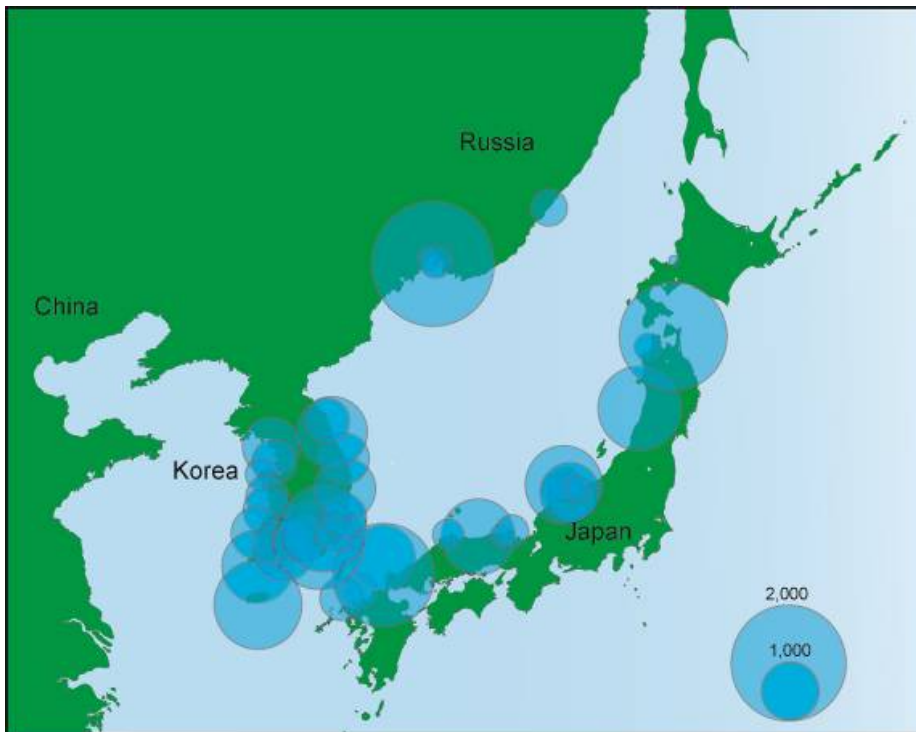
The metal concentrations in mussel *C. grayanus* along with metal pollution of bottom sediments show clear threshold reflecting advantages and limitation of such monitoring



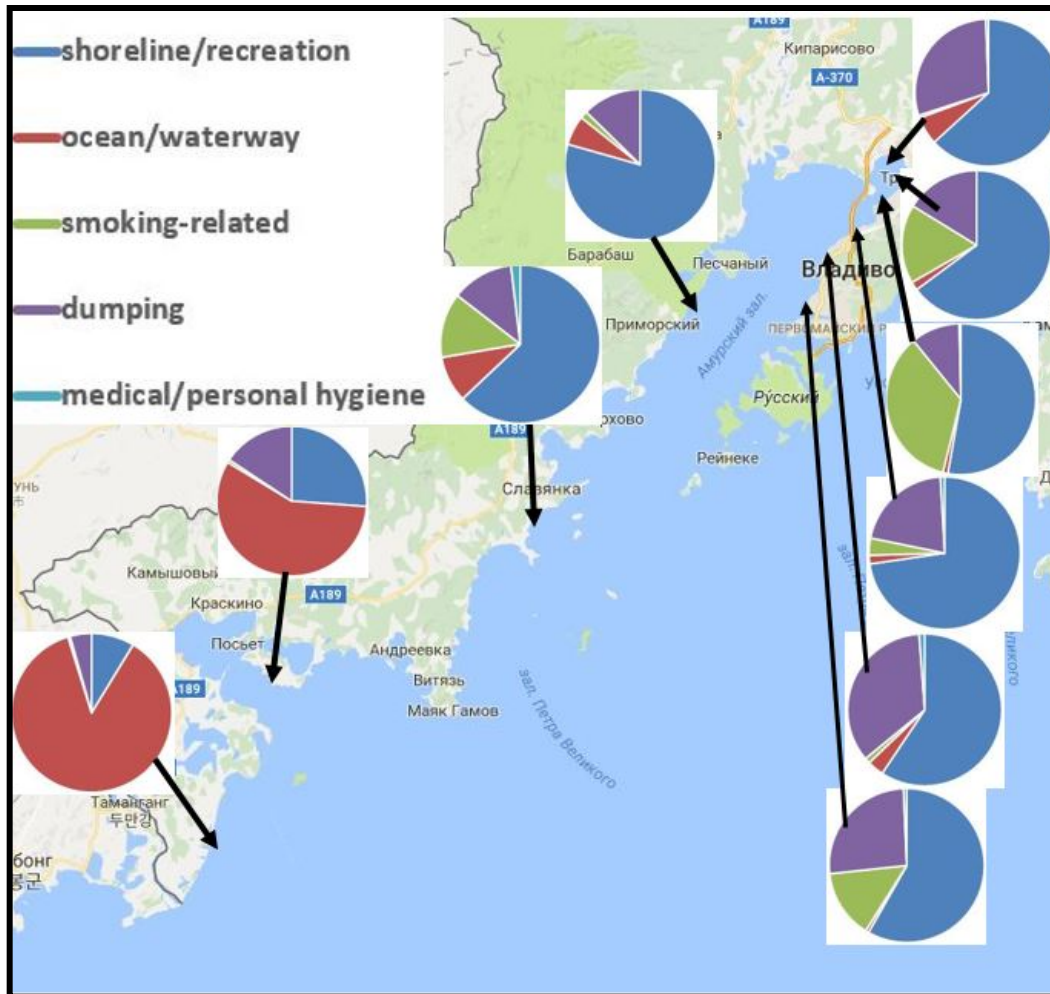
EcoQO 5: Marine litter does not adversely affect coastal and marine environments

Operational criteria	Suggested indicators	China	Japan	Korea	Russia
5.1. Characteristics of litter in the marine and coastal environment	<p>5.1.1. Trends in the amount and composition of litter washed ashore</p> <p>5.1.2. Trends in the amount of litter in the water column and deposited on the seafloor</p> <p>5.1.3. Trends in the amount, distribution and composition of micro-particles</p>	<p>5.1.1. Possible</p> <p>5.1.2. Data are very limited</p> <p>5.1.3. Under development</p>	<p>Possible (using data from national/local surveys)</p>	<p>5.1.1. Possible</p> <p>5.1.2. Possible</p> <p>5.1.3. Possible</p>	<p>5.1.1. Possible</p> <p>5.1.2. Data are very limited</p> <p>5.1.3. Data are very limited</p>
5.2. Impacts of litter on marine life	Trends in the amount and composition of litter ingested by marine animals	Not at this moment	Data not available	Not at this moment, under development	Not at this moment

Distribution of marine litter in the NOWPAP region in 2010. The map on the left shows the amount of marine litter per 100m², and the map on the right shows the weight per 100m² at each site. The size of circles indicates the amount and the weight of marine litter respectively.

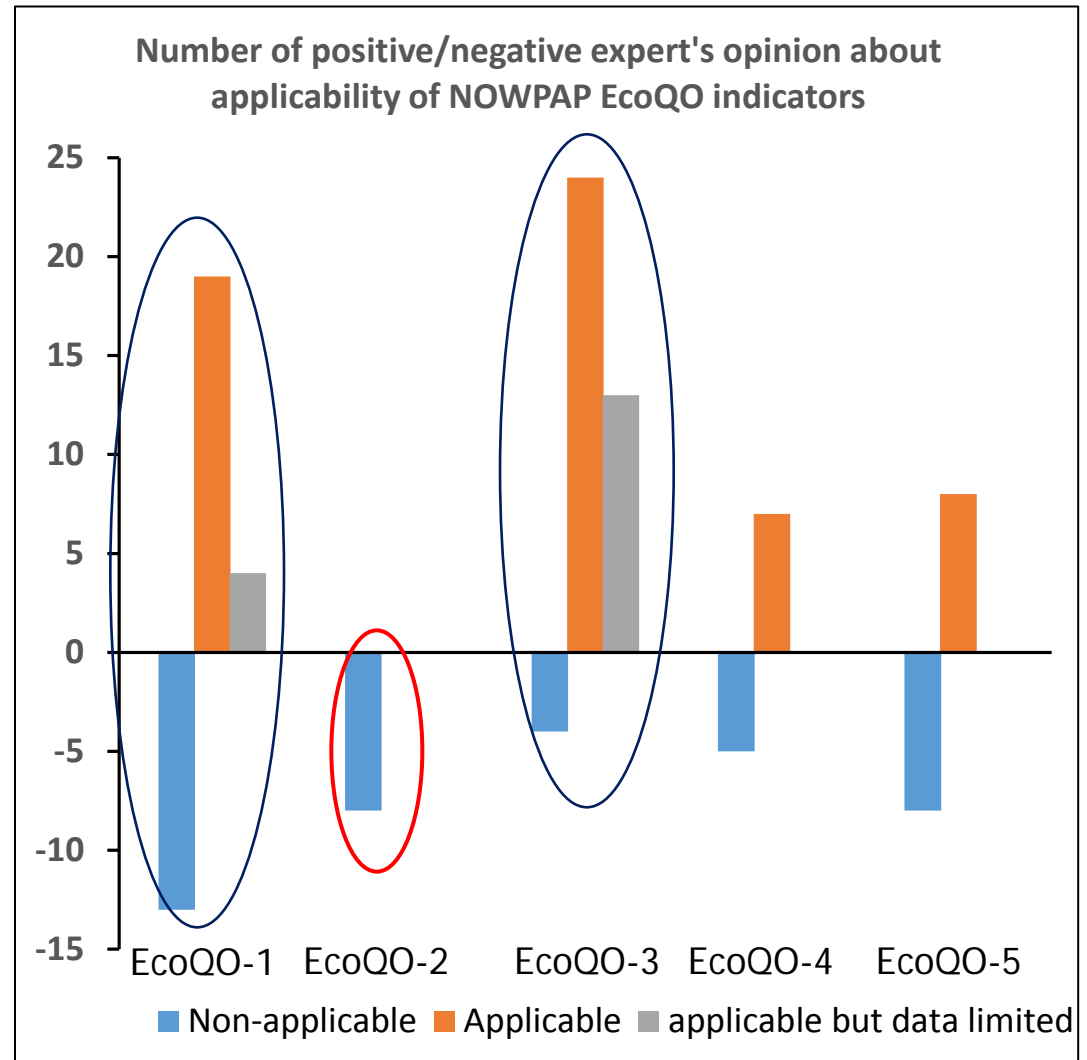


Spatial distribution of main categories of beached marine litter (by source) in the Peter the Great Bay (in percent):



Relevance of the suggested EcoQO indicators to the existent practices in the NOWPAP countries

- Significant portion of EcoQO indicators has limited applicability to the decision of environmental problems in NOWPAP countries now
- “Alien species” indicators are less applicable, and “Eutrophication” indicators are most “mature”, but in some countries data is limited



Reasons of the difficulties at the implementation of indicators for EcoQOs in the NOWPAP region:

- Shortage in time-series does not allow reliable trends in the changes of many suggested indicators;
- **Lack of an international legal framework for the regional integration of environmental quality data;**
- Some differences in the national monitoring systems (including different methods used);
- **High diversity of climatic features and unevenness of the social economic conditions hampers the unification of the indicators values for EcoQOs.**

General difficulties in the implementation of indicators for EcoQOs

- There is no available principles of integration of indicators for individual EcoQOs in the overall assessment of the state of the environment;
- Quantitative assessment of individual indicators and integrated indicators means necessity of “background” conditions that is very difficult sometimes;
- **Spatial heterogeneity of anthropogenic load, conducting of environmental studies on local areas, and the need for extrapolation of the estimates at the regional level with possible risk of “boundary effects”;**
- Overall shortage of funding even in EU where a lot of environmental funding are legally secured.

The way forward in the implementation of indicators for EcoQOs within NOWPAP region

- Recently a set of SDGs (Sustainable Development Goals) has been adopted by the UN General Assembly in December 2015 and their practical implementation has started. SDG 14 “Conserve and sustainably use the oceans, seas and marine resources for sustainable development” directly connects with EcoQOs issues;
- EcoQOs indicators should be aligned with those of SDGs
- Overcoming of the environmental assessment difficulties associated with uneven socio-economic development is possible only through increased international cooperation and joint analysis of estimates obtained in different countries;
- Harmonization of the monitoring systems and methods through the international regional collaboration continue to be one of the most important task;

Thank you for attention

